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SUPPLEMENT ARTICLE

WILEY CLINICAL ORAL IMPLANTS RESEARCH

Implant supported cantilevered fixed dental rehabilitations in partially edentulous patients: Systematic review of the literature. Part I.

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Abstract

Objectives: To investigate in which clinical situations a cantilever fixed implant supported restorations can be a treatment alternative and which complications are reported.

Materials and Methods: Two operators screened the literature (MEDLINE, EMBASE) and performed a hand search on the main journals dealing with implantology and prosthetics until 31 December 2017. Only articles that considered cantilever implant fixed restorations with at least 10 patients and with a mean follow-up of at least 5 year were selected. The outcome variables were survival of implants and prosthesis, mechanical, technical and biological complications, marginal bone loss. The review was performed according to the PRISMA statements. Risk of bias assessment was evaluated. Failure and complication rates were analysed using random effect Poisson regression models to obtain summary estimate of 5- and 10-year survival and complication rates.

Results: A total of nine papers were selected for partially edentulous patients and reported high survival rate of the prosthesis. The estimated survival rate for 5–10 years was calculated to be 98.4% for the implants and 99.2% for the rehabilitations. Mechanical, technical and biological complications were reported with a cumulative 5–10 years complication rate of 28.66% and 26.57% for the patients and for the prosthesis, respectively. Two papers for single implant supporting 2-unit cantilever were not sufficient to draw conclusions.

Conclusions: There is evidence that cantilever can be successful treatment in partially edentulous patients. In two adjacent edentulous sites, data are not yet sufficient.

1 | INTRODUCTION

Implant placement can be limited by anatomical conditions that may be overcome with different solutions: reduced dimension implants, surgical bone augmentation procedures or different prosthetic designs. Other systematic reviews have pointed out how major reconstructions can be effective but need to be carefully applied in cases with ideal conditions (Chiapasco, Zaniboni, & Boisco, 2006; Esposito, Grusovin, Worthington, & Coulthard, 2006). On the other hand, short or tilted implants can be a less invasive and effective procedure, provided the bone is sufficient for their placement (Del Fabbro, Bellini, Romeo, & Francetti, 2012; Zinsli, Sägesser, & Mericske, 2004).

This concept was borrowed from the prosthetic rehabilitation of periodontally treated patients, where cantilevered

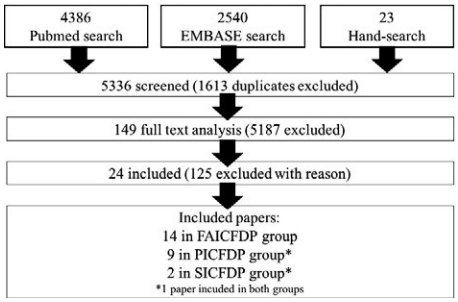

FIGURE 1 Flow chart

prosthesis supported by natural teeth was used. Tooth supported cantilever FPD were reported to have statistically higher incidence of failure than non-cantilevered tooth supported FPDs (Pjetursson, Bragger, Lang, & Zwahlen, 2007).

One of the prosthetic alternatives is the use of cantilevered prostheses (Implant cantilevered fixed dental prostheses, ICFDP). This is an option in anatomical compromised locations, or in patients that have limited financial means to afford complex treatments. In such design, nor implants nor biomaterials are placed in resorbed areas, thus reducing the risk for failures and lowering the invasiveness of the treatment. The biomechanical risk of cantilever may be that of overloading the rehabilitations, leading to implant and/or prosthetic failure. In vitro studies have revealed that higher stress to the implant closest to the cantilever extension may be concentrated at the marginal bone level and may pose a risk to marginal bone loss. (Sertgoz & Guvener, 1996; Stegaroiu, Sato,

TABLE 1 Excluded studies

Cantilever data not retrievable	Koller, Pereira-Cenci and Boscato (2016); Ozgur, Kazancioglu, Demirtas, Deger and Ak (2016); Mangano et al. (2014); Ekfeldt, Zellmer and Carlsson (2013); Degidi, Nardi and Piattelli (2013); Wittneben et al. (2014); Heschl et al. (2012); Ortorp and Jemt (2012); Malo, de Araújo Nobre, Lopes, Moss and Molina (2011); Krennmair, Seemann, Schmidinger, Ewers and Piehslinger (2010); Eliasson et al. (2010); Davó (2009); Isaksson, Becktor, Brown, Laurizohn and Isaksson (2009); Degidi, Iezzi, Perrotti and Piattelli (2009); Ortorp and Jemt (2009); Gualini, Gualini, Cominelli and Lekholm (2009); Blanes, Bernard, Blanes and Belser (2007); Rasmusson, Roos and Bystedt (2005); Hartman and Cochran (2004); Åstrand et al. (2004); Attard and Zarb (2004); Ekelund, Lindquist, Carlsson and Jemt (2003); Murphy, Absi, Gregory and Williams (2002); Raghoebar, Timmenga, Reintsema, Stegenga and Vissink (2001); Tinsley, Watson and Russell (2001); Brägger, Aeschlimann, Bürgin, Hämmerle and Lang (2001); Friberg, Gröndahl, Lekholm and Brånemark (2000); Becker and Kaiser (2000); Schwartz-Arad, Gulayev and Chaushu (2000); Arvidson, Bystedt, Frykholm, von Konow and Lothigius (1998); Schwartz-Arad and Chaushu (1998); Keller, Tolman and Eckert (1998); Parein, Eckert, Wollan and Keller (1997); Schnitman, Wöhrle, Rubenstein, DaSilva and Wang (1997); Jemt and Lekholm (1995); Brånemark, Svensson and van Steenberghe (1995); Hemmings, Schmitt and Zarb (1994); Naert, Quirynen, van Steenberghe and Darius (1992); Zarb and Schmitt (1991)
Non-human study	Costa, Santos, Nary and Brånemark (2015); Kupeyan and Clayton (2004); McAlarney and Stavropoulos (2000)
Mean follow-up <5 years	Correia, Gouveia, Felino, Costa and Almeida (2017); Wang, Judge and Bailey (2016); Tartaglia, Maiorana, Gallo, Codari and Sforza (2016); Francetti et al. (2015); Mundt, Heinemann, Schwahn and Biffar (2012); Lee et al. (2011); Francetti, Romeo, Corbella, Taschieri and Del Fabbro (2012); Mangano et al. (2011); Lai et al. (2008); Nedir, Bischof, Szmukler-Moncler, Belser and Samson (2006); Ibañez et al. (2005); Balshi, Wolfinger and Balshi (2005); Becker (2004); Romeo et al. (2003); Engstrand et al. (2003); Ahrén and Kahnberg (2001); Brocard et al. (2000); Eliasson, Palmqvist, Svenson and Sondell (2000); Haas, Mendorff-Pouilly, Mailath and Bernhart (1998); Kucey (1997); Gotfredsen (1997); Carlson and Carlsson (1994)
Number of patients < 10	Deporter, Ogiso, Sohn, Ruljancich and Pharoah (2008); Van Nimwegen et al. (2017); Fischer and Stenberg (2013)
On natural teeth	Lam, Botelho and McGrath (2013); Cordaro, Ercoli, Rossini, Torsello and Feng (2005)
Out of topic (no cantilever)	Agliardi, Romeo, Panigatti, de Araújo Nobre and Maló (2017); Malo, de Araujo Nobre, Guedes and Almeida (2017); Niedermaier et al. (2017); Zanolla et al. (2016); Lee, Kweon, Choi and Kim (2016); Esposito et al. (2016); Cavalli et al. (2016); Zhang, Shi, Gu and Lai (2016); Imburgia and Del Fabbro (2015); Ata-Ali et al. (2015); Tealdo et al. (2014); Pettersson and Sennerby (2015); Ravald, Dahlgren, Teiwik and Gröndahl (2013); Kim et al. (2013); Al-Nawas et al. (2012); Ozkan, Akoğlu and Kulak-Ozkan (2011); Browaeys et al. (2011); Lethaus, Kälber, Petrin, Brandstätter and Weingart (2011); Mura (2012); Schrott, Jimenez, Hwang, Fiorellini and Weber (2009); Botticelli, Renzi, Lindhe and Berglundh (2008); Friberg, Raghoebar, Grunert, Hobkirk and Tepper (2008); Astrand, Ahlqvist, Gunne and Nilson (2008); Glauser, Zembic, Ruhstaller and Windisch (2007); Jaffin, Kolesar, Kumar, Ishikawa and Fiorellini (2007); Romeo, Ghisolfi, Rozza, Chiapasco and Lops (2006); Romeo, Lops, et al. (2006); Sullivan, Vincenzi and Feldman (2005); Quirynen et al. (2005); Degidi and Piattelli (2005); Vigolo, Givani, Majzoub and Cordioli (2004); Zinsli et al. (2004); Lambrecht, Filippi, Künzel and Schiel (2003); Davis, Packer and Watson (2003); Weng et al. (2003); Attard and Zarb (2003); Brosky, Korioth and Hodges (2003); Naert et al. (2002); Fortin, Sullivan and Rangert (2002); Wyatt and Zarb (2002); Attard and Zarb (2002); Zarb and Zarb (2002); Ferrigno, Laureti, Fanali and Grippaudo (2002); Sullivan, Sherwood and Porter (2001); Ekfeldt et al. (2001); Hellem et al. (2001); Merickse-Stern, Aerni, Geering and Buser (2001); Allen, McMillan and Walshaw (2001); Vajdovich and Fazekas (1999); Noack, Willer and Hoffmann (1999); Schliephake, Schmelzeisen, Husstedt and Schmidt-Wondera (1999); Chaushu and Schwartz-Arad (1999); Makkonen et al. (1997); Zarb and Schmitt (1993)
Same pool of patients of other article	Cavalli, Corbella, Taschieri and Francetti (2015); Fischer, Stenberg, Hedin and Sennerby (2008)

TABLE 2 Study and patient characteristics of the included studies (partial prostheses)

Study	Implant system	Study design	Mean Follow-up, years (range)	No. implants placed (ICFDPs/patients)	No. implants available for analysis (ICFDPs/patients)	Age range (mean), years	Setting	Type of extension	Location of reconstruction
Romeo et al. (2009)	Straumann Dental Implant System®	Prospective	8	148 (75/59)	116 (59/45)	42–100 (63)	Hospital	Mixed	33 maxilla, 26 mandible
Kreissl et al. (2007)	3i Osseotite®	Prospective	5	61 (23/20)	61 (23/20)	NR (NR)	NR	Monolateral	Maxilla and mandible
Brägger et al. (2005)	Straumann Dental Implant System®	Prospective	9.4	33 (18/14)	33 (18/14)	20–78 (42.9)	University	Mixed	11 maxilla, 7 mandible
Wennström et al. (2004)	Astra Tech® Dental Implant System	Prospective	5	NR (28/28)	66 (24/24)	NR (57)	University	Distal	16 maxilla, 8 mandible
Jokstad et al. (2017)	Brånemark System®	Retrospective	17.5	NR (NR/NR)	58 (24/24)	17–73 (45)	University	Monolateral	Maxilla and mandible
Malo et al. (2013)	Brånemark System®	Retrospective	5	185 (150/137)	153 (119/113)	17–84 (49)	Private clinic	Monolateral	Maxilla and mandible
Aglietta et al. (2012)	Straumann Dental Implant System®	Retrospective	5.5	42 (21/21)	42 (21/21)	NR (54.6)	University	Monolateral (9 mesial/2distal	14 maxilla, 7 mandible
Hälg et al. (2008)	Straumann Dental Implant System®	Retrospective	5	38 (19/19)	34 (17/17)	44–83 (61.9)	Private clinic	Monolateral	9 maxilla, 10 mandible
Eliasson et al. (2006)	Brånemark System®	Retrospective	9.8	209 (84/84)	176 (71/71)	NR (NR)	University	Mixed	NR

ICFDPs: implant-supported, cantilever-fixed dental prostheses; NR: not reported.

TABLE 3 Implant and prosthesis characteristics of the included studies (Partial prostheses)

Study Prospective/ Retrospective	No. implants available for analysis (ICFDPs/ patients)	Implant system	Surface	Implant diameter (mm)	Implant lenght (mm)	Loading	Type of extension	Location of reconstruction	Fixation	Type of material
Romeo et al. (2009) Prospective	116 (59/45)	Straumann Dental Implant System®	N/A	3.3–4.1–4.8	8.0–14.0	Conventional >3 months	Mixed	33 maxilla, 26 mandible	Cemented and screw-retained	Metal-ceramic
Kreissl et al. (2007) Prospective	61 (23/20)	3i Osseotite®	Smooth	NR	NR	NR	Monolateral	Maxilla and mandible	Screw-retained	Metal-ceramic
Brägger et al. (2005) Prospective	33 (18/14)	Straumann Dental Implant System®	Rough	NR	NA	Conventional >3 months	Mixed	11 maxilla, 7 mandible	Cemented and screw-retained	Metal-ceramic
Wennström et al. (2004) Prospective	66 (24/24)	Astra Tech® Dental Implant System	Rough/ Smooth	3.5	8–19	Conventional >3 months	Distal	16 maxilla, 8 mandible	Screw-retained	Metal-ceramic
Jokstad et al. (2017) Retrospective	58 (24/24)	Brånemark System®	Smooth	≤4.5	≤14	NR	Monolateral	Maxilla and mandible	Screw-retained	Resin
Malo et al. (2013) Retrospective	153 (119/113)	Brånemark System®	Rough/ Smooth	3.3–3.75–4.0	8.5–18.0	Immediate/ Early/ Conventional	Monolateral	Maxilla and mandible	Cemented and screw-retained	Ceramic; Metal ceramic; Metal-resin
Aglietta et al. (2012) Retrospective	42 (21/21)	Straumann Dental Implant System®	Rough	4.1–4.8	NR	NR	Monolateral (9 mesial/2distal	14 maxilla, 7 mandible	Cemented and screw-retained	NA
Hälg et al. (2008) Retrospective	34 (17/17)	Straumann Dental Implant System®	Smooth	<=4.5	6.0–12.0	Conventional >3 months	Monolateral	9 maxilla, 10 mandible	Cemented	Metal-ceramic
Eliasson et al. (2006) Retrospective	176 (71/71)	Brånemark System®	Smooth	3.75	6–18	NR	Mixed	NR	Screw-retained	Metal-resin/ Metal-ceramic

ICFDPs: implant-supported, cantilever-fixed dental prostheses; NR: not reported.

TABLE 4 Study and patient characteristics of the included studies (single implant)

Study	Implant system	Study design	Mean Follow-up, years (range)	No. implants placed (ICFDPs/patients)	No. implants available for analysis (ICFDPs/patients)	Age range (mean), years	Setting	Type of extension	Location of reconstruction
De Angelis et al. (2017)	Winsix	Retrospective	13.6 (10–18)	28 (28/28)	25 (25/25)	NR (NR)	University	Monolateral	15 maxilla, 10 mandible
Aglietta et al. (2012)	Straumann dental implant system	Retrospective	6.5 (NR)	19 (19/17)	19 (19/17)	NR (54.6)	University	Monolateral, 9 mesial, 10 distal	5 maxilla 14 mandible

ICFDPs: implant-supported, cantilever-fixed dental prostheses; NR: not reported.

TABLE 5 Risk of bias summary (partial prostheses)

	Blinding of outcome assessment	Comparability of control and treatment groups at entry	Clear definition of inclusion and exclusion criteria	Outcome measurement method description	Completeness of the outcome data reported	Recall rate	Sample size	Number of surgeon involved
Hälg et al. (2008)	−	+	?	+	+	?	+	+
Wennström et al. (2004)	−	+	+	+	+	+	−	+
Romeo et al. (2009)			+	+	+	−	+	?
Kreissl et al. (2007)			−	+	+	+	−	?
Brägger et al. (2005)			−	+	+	?	−	−
Eliasson et al. (2006)			−	−	+	+	+	?
Jokstad et al. (2017)			−	+	+	+	+	?
Malo et al. (2013)			+	+	+	+	+	?
Aglietta et al. (2012)			+	+	+	+	−	?

Note. +, Low risk of bias; −, High risk of bias; ?, moderate risk of bias.

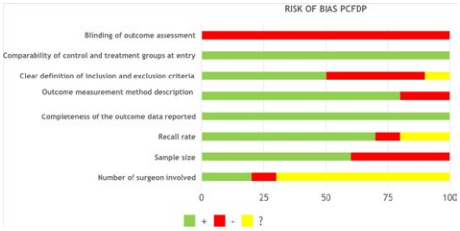

FIGURE 2 Risk of bias graph (partial prostheses)

Kusakari, & Miyakawa, 1998; Zampelis, Rangert, & Heijl, 2007). By contrast, in humans the results of higher stresses on implants remain unclear.

Few systematic reviews have been published on the topic in the past years, two in 2009 (Aglietta et al., 2009; Zurdo, Romão, & Wennström, 2009) and one in 2012 (Romeo & Storelli, 2012). All of them considered the outcome of cantilevered prostheses used in fixed partial dentures (Partial implant cantilevered fixed dental proshesis, PICFDP): the analysis was carried out on papers treating the cantilever solution in partial edentulism and mostly in posterior areas.

In literature, by contrast, other use of cantilever can be found also in fully edentulous cases (full arch implant cantilevered fixed dental prosthesis, FAICFDP) and in cases where one implant supports two teeth (single implant cantilevered fixed dental prosthesis, SICFDP) (Aglietta et al., 2012).

The main objective of this systematic review was to assess the survival and complication rate of implant supported cantilever fixed dental prosthesis (ICFDP) in different clinical situations.

2 | MATERIAL AND METHODS

The present systematic review was designed to report data on full arch and partial fixed reconstructions with cantilever. The present review is reported according to the PRISMA (Preferred Reporting Items Systematic review and Meta-Analyses) statement (Liberati et al., 2009; Moher, Liberati, Tetzlaff, & Altman, 2009).

The focused question was: "In what clinical situations and with what implant systems are cantilevers a successful treatment modality?" The preliminary PICO assessment was used to define the search strategy with the following criteria.

2.1 | Types of participants

Patients who received cantilevered implant supported rehabilitations.

2.2 | Types of interventions

Any rehabilitations that was produced with cantilevered teeth. Three different kinds of restorations were investigated: full-arch fixed restorations, fixed partial restorations and single implants supporting two-crown restorations.

2.3 | Types of outcome measures

Several variables were considered for analysis:

- Implant survival rate
- Prosthetic survival rate
- Biological complications
- Prosthetic complications (Mechanical and Technical)
- Marginal bone loss

Other variables were searched and described when present: loading time of the rehabilitations, reconstruction material, implant system used.

2.4 | Types of studies

The present systematic review considered both prospective and retrospective studies, randomized and controlled clinical trials as well as cohort studies and case series. Studies had to report data on minimum 10 participants and have a minimum of 5-year follow-up.

2.5 | Search strategy

The English literature was first searched up to July 2017 and a second search was carried out up to December 2017. Two electronic databases were searched: The National Library of Medicine (MED- LINE by PubMed) and EMBASE. The following terms were searched in combination: dental implant AND (cantilever or extension or "fixed dental prosthesis" or "fixed partial denture" or "full arch" or "fixed complete restoration" or "fixed complete prostheses" or "single implant" or "single tooth"). Moreover, the issues from 2015 to July 2017 of the following journals were hand searched: Clinical

TABLE 6 Risk of bias summary (single implant)

	Clear definition of inclusion and exclusion criteria	Outcome measurement method description	Completeness of the outcome data reported	Recall rate	Sample size	Number of surgeon involved
De Angelis et al. (2017)	+	−	+	+	+	?
Aglietta et al. (2012)	+	+	+	+	−	?

Note. +, Low risk of bias; −, High risk of bias; ?, moderate risk of bias.

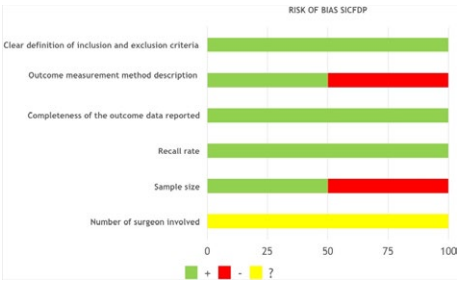

FIGURE 3 Risk of bias graph (single implant)

Oral Implants Research, International Journal of Periodontics and Restorative Dentistry, Journal of Periodontology, Journal of Clinical Periodontology, International Journal of Oral and Maxillofacial Implants, Journal of Prosthetic Dentistry, Journal of Prosthodontics, Journal of Oral Rehabilitations. Moreover, the bibliographies of previous systematic reviews on the topic as well as selected articles were thoroughly screened. The aim of the review was to screen the literature for papers reporting at least a mean of 5-year follow-up data on cantilevered rehabilitations, both in fully edentulous and partially edentulous cases.

2.6 | Inclusion criteria

Both retrospective and prospective studies were selected with a mean follow-up of a minimum of 5 years and at least 10 rehabilitations. RCTs, Cohort and Case-Control studies on implant supported cantilever restorations were considered. The primary outcome was prosthetic and implant survival. Secondary outcome was complication rates (mechanical, technical and biological) and marginal bone loss. Moreover, information regarding implant manufacturer and abutment characteristics as well as influence of retention (cemented or screw retained) was assessed.

2.7 | Exclusion criteria

Papers were not meeting all inclusion criteria. Papers with a less than 5-year follow-up and/or with less than 10 patients were excluded. Letters, narrative reviews, questionnaires and charts were also excluded. Studies from which data on selected outcome variables could not at all be retrieved or calculated were not considered. Also, papers reporting data from the same cohort were excluded, except for the one with the longest follow-up.

2.8 | Study selection

The pool of retrieved articles was screened for duplicates by undergraduate students of the department (Stefano Corti and Elisabetta Morfini). All identified titles and abstract were then independently screened by two review authors (SS and GP). Full text was obtained either for articles meeting the inclusion criteria or for those whose abstract presented unclear data. The full texts were then assessed by two authors (SS and GP) that defined if the articles were to be included or not. Any disagreement was resolved by discussion with the other reviewers (ER and MDF).

2.9 | Data extraction

Data were extracted by two review authors (SS and GP) using data collection forms. Study setting and design, implant manufacturer and data on restorations were extracted. Survival rate of implant and prosthesis were extracted or calculated from the original articles. Implant survival was considered if the implant was present at the follow-up examination; prosthesis survival was considered if the restoration was present at the follow-up visit without any modifications. Prosthesis complications were considered all the events affecting the abutment and/or the meso- and/or the supra-structures' integrity and were divided into mechanical and technical complications.

Implant/abutment related technical complications were considered those affecting the integrity of the implant and the abutment and were reported in tables as fracture of the implant, abutment and screws and abutment loosening. Restoration-related technical complications were considered to be those affecting the prosthetic rehabilitation: loss of retention (i.e., unscrewing of occlusal screws for screw-retained rehabilitations and decementations for cemented restorations), veneer chipping, fracture of framework. Biological complications comprised peri-implantits and mucositis. Moreover, when reported, data on marginal bone loss were also extracted.

When the reported data were unclear, authors contacted by emails the corresponding authors and asked for more informations.

2.10 | Risk of bias assessment

The risk of bias assessment for the included trials was performed independently by two reviewers (SS and GP), using a purposely designed risk of bias assessment tool with the following domains:
Randomized Studies:

- Random sequence generation method
- Allocation concealment

Comparative Studies:

- Blinding of outcome assessment
- Comparability of control and treatment groups at entry

All Studies:

- Definition of inclusion and exclusion criteria
- Outcome measurement method description
- Completeness of the outcome data reported

Randomized studies were not considered as such if the randomization purpose was not the use of cantilever restorations. In that case, the study was considered only a prospective study.

Recall rate (it was assumed as low risk if the dropout rate was <10%, unclear if it was between 10% and 20%, high risk if it was >20%).

TABLE 7 Annual failure rates and survival of implants/ICFDPs (partial prostheses)

Study	No. implants/ ICFDPs available for the analysis (patients)	Mean follow-up time (years)	No. failures implants/ICFPDs	Total implants/ ICFDPs exposure time	Estimated failure rate (per 100 implants/ICFDPs years)	Estimated implant/ ICFDP survival rate after 5–10 years	Mean MBL, mm	Estimated MBL after 5 years
Romeo et al. (2009)	116/59 (45)	8	0/0	928/472	0.00/0.00	100%/100%	1.1	0.69
Kreissl et al. (2007)	61/23 (20)	5	1/1	305/115	0.33/0.87	98.4%/95.7%	NR	NE
Brägger et al. (2005)	33/18 (14)	9.4	1/3	310.2/169.2	0.32/1.77	98.4%/91.1%	NR	NE
Wennström et al. (2004)	66/24 (24)	5	2/2	330/130	0.61/1.54	97.0%/92.3%	0.39 ± 1.04	0.39
Summary estimate prospective studies						98.93 (96.5, 100.4) 96.6 (95.19, 101.1)		0.54 (−1.36, 2.45)
Jokstad et al. (2017)	58/24 (24)	17.5	1/0	1,015/420	0.10/0.00	99.5%/100%	NR	NE
Malo et al. (2013)	153/119 (113)	5	3/1	765/595	0.39/0.17	98.0%/99.2%	1.84	1.84
Aglietta et al. (2012)	42/21 (21)	5.5	0/0	231/115.5	0.00/0.00	100%/100%	0.25 ± 0.55	0.23
Hälg et al. (2008)	34/17 (17)	5	2/3	170/85	1.18/3.53	94.1%/82.4%	0.27	0.27
Eliasson et al. (2006)	176/71 (71)	9.8	3/0	1,724.8/695.8	0.17/0.00	99.1%/100%	NR	NE
Summary estimate retrospective studies						98.85 (88.4, 101.1) 99.0 (86.65, 106.0)		0.78 (−1.5, 3.06)
Total Summary estimate (95% CI)*						98.90 (96.86, 99.70)*/98.20 (90.96, 100.3)		0.68 (−0.15, 1.52)

ICFDPs: implant-supported, cantilever-fixed dental prostheses; MBL: marginal bone loss; NR: not reported.

*Based on random effects Poisson regression, test for heterogeneity, $p = 0.34/p = 0.11$.

TABLE 8 Overall complications (partial prostheses)

Study	No. implants/ICFDPs available for the analysis (patients)	Mean follow-up time (years)	Total patients exposure time	Total prostheses exposure time	Total No. complications	Estimated complication rate (per 100 patients years)	Estimated complication rate (per 100 prostheses years)
Romeo et al. (2009)	116/59 (45)	8	360	472	22	6.11	4.66
Kreissl et al. (2007)	61/23 (20)	5	100	115	14	14.00	12.17
Brägger et al. (2005)	33/18 (14)	9.4	131.6	169.2	14	10.64	8.27
Wennström et al. (2004)	66/24 (24)	5	120	120	6	5.00	5.00
Cumulative 5-year complication rate prospective studies						39.35% (11.56, 77.81)	31.96% (9,79, 65.48)
Jokstad et al. (2017)	58/24 (24)	17.5	420	420	8	1.90	1.90
Malo et al. (2013)	153/119 (113)	5	565	595	51	9.03	8.57
Aglietta et al. (2012)	42/21 (21)	5.5	115.5	115.5	NR	NR	NR
Hälg et al. (2008)	34/17 (17)	5	85	85	9	10.59	10.59
Eliasson et al. (2006)	176/71 (71)	9.8	695.8	695.8	18	2.59	2.59
Cumulative 5-year complication rate retrospective studies						24.35% (−5.04, 65.30)	23.94% (−4.83, 63.9)
Cumulative 5–10 year complication rate (95% CI)*						28.66% (19.56, 55.26)	26.57% (17.96, 49.24)

ICFDPs: implant-supported, cantilever-fixed dental prostheses; NE: not estimable; NR: not reported.

*Based on random effects Poisson regression, test for heterogeneity for complications (per patients/prostheses), $p = 0.18$/$p = 0.08$.

TABLE 9 Mechanical complications: implant/abutment-related complications (partial prostheses)

Study	No. implants available for the analysis (patients)	Mean follow-up time (years)	Total implants exposure time	No. of implant fracture	Estimated rate of implant fractures (per 100 implants years)	No of abutment or screw fracture	Estimated rate of abutment or screw fractures (per 100 patients/year)
Romeo et al. (2009)	116 (45)	8	928	0	0	0	0.00
Kreissl et al. (2007)	61 (20)	5	305	0	0	0	0.00
Brägger et al. (2005)	33 (14)	9.4	310.2	1	0.32	1	0.76
Wennström et al. (2004)	66 (24)	5	330	0	0	1	0.83
Cumulative 5-year complication rate prospective studies					0.27% (−0.88, 1.68)		1.41% (−1.68, 5.66)
Jokstad et al. (2017)	58 (24)	17.5	1,015	0	0	1	0.24
Malo et al. (2013)	153 (113)	5	765	NR	NE	NR	NE
Aglietta et al. (2012)	42 (21)	5.5	231	NR	NE	NR	NE
Hälg et al. (2008)	34 (17)	5	170	2	1.18	0	0.00
Eliasson et al. (2006)	176 (71)	9.8	1,724.8	0	0	3	0.43
Cumulative 5-year complication rate retrospective studies					0.34% (−6.47, 10.39)		1.67% (−1.57, 3.80)
Cumulative 5–10 year complication rates (95% CI)*					0.31% (−0.97, 3.11)		1.57% (−0.05, 3.29)

*Based on random effects Poisson regression, test for heterogeneity $p = 0.10$ for implant fractures. Based on Poisson regression, test for heterogeneity $p = 0.08$ for abutment/screw fractures.

Sample size (it was considered low risk if >30 patients were treated, high risk if <30 patients were treated).

Number of surgeons involved (it was considered low risk if the same surgeon performed all operations, high risk if more than one surgeon performed all operations).

Each domain was judged as at low, unclear or high risk of bias according to the evaluation criteria as described in the Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0. A domain was evaluated as unclear when it was doubtful or not specified in the article. Cases of disagreement were resolved by discussion.

After judgement was given for each of the above-mentioned domains, studies were grouped into the following categories:

- Low risk of bias (plausible bias unlikely to seriously alter the results) if all criteria were met
- Moderate risk of bias (plausible bias that raises some doubt about the results) if one or more criteria were partly met or were assessed as unclear
- High risk of bias (plausible bias that seriously weakens confidence in the results) if one or more criteria were not met.

2.11 | Statistical analysis

Failure and complication rates were calculated by dividing the number of events (failures or complications) in the numerator by the total exposure time (implant, patient or prosthesis-time) in the denominator, similar to previous systematic reviews (Romeo & Storelli, 2012). Failures and complications were directly extracted from the publications, as well as the mean follow-up time. Exposure time was calculated by multiplying the mean follow-up time by the number of implants or ICFDPs available. The mean follow-up duration was directly extracted by the articles, provided by adjunctive information by the authors or estimated from the original data. For further analysis, the total number of events was considered to be Poisson distributed for a given sum of implant exposure years, and Poisson regression with a logarithmic link function and total exposure time per study as an offset variable was used (Kirkwood & Sterne, 2003). Event rates for implants and prostheses were calculated by dividing the total number of events by the respective total exposure time in years.

Robust standard errors were calculated to obtain 95% confidence intervals of the summary estimates of the event rates. To assess heterogeneity of the study-specific event rates, the Spearman goodness-of-fit statistics and associated *p*-value were calculated. If the goodness-of-fit *p*-value was below 0.05, indicating heterogeneity, random effects Poisson regression (with Gamma-distributed random effects) was used to obtain a summary estimate of the event rates. Five- and 10-year survival and complication proportions were estimated through the relationship between event rate and survival function S, S(T) = exp(−T × event rate), assuming constant event rates (Kirkwood & Sterne, 2003). Ninety-five per cent confidence intervals (CIs) of the summary estimates of the event rates obtained from the Poisson regression were reported. The 95% CIs for survival probabilities were obtained using the 95% confidence limits from the summary event rates. All analyses were performed using IBM SPSS Statistics version 24 (IBM Corporation, Armonk, NY).

Regarding the reported radiographic bone loss, the mean difference between implants close to and distant from cantilevers, or belonging to non-cantilevered FPDs, and its standard error was calculated for each study. Such study-specific differences were then meta-analysed using the inverse-variance weighting method. Random effects model was used if no heterogeneity among studies was detected, otherwise a fixed effects model was chosen, following the directions of the Cochrane Handbook for Systematic Reviews of Interventions (Version 5.1.0, March 2011). Heterogeneity among studies was assessed with Cochran's test for heterogeneity, with a significance threshold of $p < 0.1$. The quantification of the heterogeneity was calculated with I^2 statistics. Review Manager 5.3 (The Nordic Cochrane Center, The Cochrane Collaboration, Copenhagen, Denmark) was used for meta-analysis calculations and plots concerning radiographic peri-implant bone loss.

3 | RESULTS

The electronic search identified a total of 6,926 titles (4386 MEDLINE, 2540 EMBASE). Another 23 titles were included after manual search. After de-duplication a total of 5,336 studies were screened. A total of 149 papers underwent full-text analysis (Figure 1). After full-text reading, 125 papers were excluded. Reasons for excluding papers were mainly follow-up less than 5 years, papers on natural teeth, in vitro or non-clinical studies. Also, papers non-clearly reporting data on cantilever were excluded. When, after discussion, there was still a doubt, authors were contacted by email and asked for better explanations. Reason for exclusion can be found in Table 1. Any disagreement was resolved by discussion. Finally, 24 papers were selected and included in the review: 10 papers were selected for the partially edentulous and 14 for the fully edentulous cantilevered restorations. In the present review only those concerning partially edentulous cantilevered restorations were considered (Tables 2, 3 and 4).

3.1 | Excluded studies

The main reason for exclusion of the full text is reported in Table 1. Out of 125 excluded papers, 54 examined prostheses without cantilevers, 39 did not report data about cantilever, 22 had a follow-up less than 5 years, 3 were non-human studies, 3 had number of patients less than 10, 2 were about rehabilitations on natural teeth, 2 had the same pool of patients as other articles with longer follow-up already included in the study. Additional 14 studies were not considered in the present review because they were included in part II (Storelli, Scanferla, Palandrani, Mosca, & Romeo, 2017).

TABLE 10 Technical complications: veneer fractures and decementation/screw loosening (partial prostheses)

Study	No. of ICFDPs available for the analysis (patients)	Mean follow-up time (years)	Total ICFDPs exposure time	No. of veneer fractures	Estimated rate of veneer fractures (per 100 patients/year)	No. of cemented ICFDPs available for loss of retention analysis
Romeo et al. (2009)	59 (45)	8	472	17	4.72	46
Kreissl et al. (2007)	23 (20)	5	115	8	8.00	0
Brägger et al. (2005)	18 (14)	9.4	169.2	1	0.76	13
Wennström et al. (2004)	24 (24)	5	120	1	0.83	0
Cumulative 5-year complication rate prospective studies					18.97% (−9.79, 45.58)	
Jokstad et al. (2017)	24 (24)	17.5	420	4	0.95	0
Malo et al. (2013)	119 (113)	5	595	29	5.13	NR
Aglietta et al. (2012)	21 (21)	5.5	115.5	NR	NE	NR
Hälg et al. (2008)	17 (17)	5	85	4	4.71	17
Eliasson et al. (2006)	71 (71)	9.8	695.8	5	0.72	0
Cumulative 5-year complication rate retrospective studies					11.99% (−4.44, 33.21)	
Total 5-year complication rate Summary estimate (95% CI)*					13.93% (4.52, 27.76)	

Test for heterogeneity $p < 0.75$ for veneers fractures, $p = 0.01$ for loss of retention, $p = 0.06$ for screw loosening.
CI: confidence interval; ICFDPs: implant-supported, cantilever-fixed dental prostheses; NA: not applicable; NE: not estimable; NR: not reported.

3.2 | Study characteristics

Studies were divided into Fixed Partial Denture (Aglietta et al., 2012; Brägger et al., 2005; De Angelis et al., 2017; Eliasson, Eriksson, Johansson, & Wennerberg, 2006; Hälg, Schmid, & Hämmerle, 2008; Jokstad et al., 2017; Kreissl, Gerds, Muche, Heydecke, & Strub, 2007; Malo, de Araujo Nobre, & Lopes, 2013; Romeo, Tomasi, Finini, Casentini, & Lops, 2009; Wennström et al., 2004) and Single Implant supporting two crown (Aglietta et al., 2012; De Angelis et al., 2017). Descriptive data regarding the characteristics of included studied were reported in Tables 2, 3 and 4.

3.3 | Risk of bias

The risk of bias summary is presented in Table 5 and Figure 2 for studies about PCFDP and in Table 6 and Figure 3 for the studies about SICFDP.

Among the studies about PCFDP nine were classified as high risk of bias (Aglietta et al., 2012; Brägger et al., 2005; De Angelis et al., 2017; Eliasson et al., 2006; Hälg et al., 2008; Jokstad et al., 2017; Kreissl et al., 2007; Romeo et al., 2009; Wennström et al., 2004) and one was classified as unclear risk of bias (Malo et al., 2013).

Both studies about SICFDP were classified as high risk of bias (Aglietta et al., 2012; De Angelis et al., 2017).

3.4 | Fixed partial rehabilitations

Nine papers were found to be suitable for fixed partial denture analysis (Aglietta et al., 2012; Brägger et al., 2005; Eliasson et al., 2006; Hälg et al., 2008; Jokstad et al., 2017; Kreissl et al., 2007; Malo et al., 2013; Romeo et al., 2009; Wennström et al., 2004). One additional study (De Angelis et al., 2017) was included in the single implant analysis but was excluded from the fixed partial denture since less that 10 patients with ICFDP were treated. Five retrospective and four prospective studies were selected: A total of 739 implants supporting 376 rehabilitations in 349 patients were followed for at least 5 years (range 5–17.5). Thirteen implants failed as leading to 10 failed rehabilitations. The estimated survival rate for 5–10 years was calculated to be 98.9% for the implants and 98.2% for the rehabilitations (Table 7). Prospective studies reported a 5–10 years survival rate of 98.93% (96.5, 100, 4% CI) and 96.6% (95.19; 101.1, 95% CI) at implant and prosthesis level, respectively. Retrospective studies reported 5–10 years survival rate of 98.85% (88.4; 101.1, 95% CI) and 99.0% (86.65, 106.0, 95% CI) at implant and prosthesis level, respectively.

A total of 142 complications (mechanical, technical and biological) were reported with a cumulative 5–10 years complication rate of 28.66% (19.56, 55.26, 95% CI) and 26.57% (17.96, 49.24, 95% CI) for the patients and for the prosthesis, respectively (Table 8).

Mechanical complications were reported in 7 studies with a total of 544 implants and 215 rehabilitations (Table 9). Three implant fractures were documented with a cumulative 5–10 years complications rate of 0.31% (−0.97; 3.11). Five cases of abutment screw fracture were documented with a 5–10 years complications rate of 1.57% (−0.05; 3.29).

Technical complications were reported in eight studies (Table 10). Six studies reported on screw retained restorations (160 restorations followed for 5–17.5 years with 16 cases of

Total cemented ICFDPs exposure time	No. of cases of loss of retention	Estimated rate of loss of retention (per 100 ICFDP year)	No. of screw-retained ICFDPs available for screw loosening analysis	Total screw-retained ICFDPs exposure time	No. of cases of screw loosening	Estimated rate of screw loosening (per 100 screw-retained ICFDP year)
368	3	0.83	13	104	0	0
NA	NA	NA	23	115	5	4.35
122.2	2	1.64	5	47	0	0
NA	NA	NA	24	120	2	1.67
		5.10% (−19.92, 32.18)				9.07% (−8.81, 23.85)
NA	NA	NA	24	420	2	0.48
NE	NR	NE	NR	NE	13	NE
NE	NR	NE	NR	NE	NR	NE
85	1	1.18	0	NA	NA	NA
NA	NA	NA	71	695.8	7	1.01
		5.88%				4.03% (−13.13, 20.54)
		5.22% (0.94, 11.15)				5.33% (−2.39, 14.89)

screw loosening), with a cumulative 5–10 years complications rate of 5.33% (−2.39; 14.89). Three studies reported on cemented restorations (76 restorations followed for 5–9.4 years with 6 cases of decementation) with a cumulative 5–10 years complications rate of 5.22% (0.94; 11.15). Eight studies (328 rehabilitations followed for 5–17.5 years) reported 69 cases of veneer fractures with a cumulative 5–10 years complications rate of 13.93% (4.52; 27.76). Six studies reported 0 framework fractures (201 rehabilitations followed for 5–17.5 years) with a cumulative 5–10 years complications rate of 0%.

Biological complications were reported in four studies (Table 11). No study reported on mucositis, instead the data retrieved from four studies showed that peri-implantitis has a cumulative 5–10 years complication rate of 3.68% (−4.84, 13.78) for the implants and 6.06% (−9.53, 24.93) for the prosthesis (95% CI).

MBL was reported in 5 studies with a range from 0.25 to 1.84 mm and an estimated MBL after 5 years of 0.68 mm (−0.15, 1.52, CI 95%) (Table 7).

Three studies (Aglietta et al., 2012; Hälg et al., 2008; Wennström et al., 2004) reported on MBL of implants near to the cantilever and distant from the cantilever. The Forest Plot (Figure 4) reported a summary estimated mean difference in bone loss per year of −0.03 (−0.24, 0.17, CI 95%). The result was not statistically significant ($p = 0.75$).

In three studies rehabilitations were supported by Branemark system implants (387 implants and 214 rehabilitations), in four studies rehabilitations were supported by Straumann dental implants system (225 implants and 115 rehabilitations) and the remaining two studies by 3i Osseotite (61 implants and 23 rehabilitations), Astra Tech Dental Implant System (66 implants and 24 rehabilitations) (Table 3).

3.5 | Single implant supporting two crowns

Two papers were selected and reported in Table 4, follow-up ranged from 6.5 to 13.6 years (Aglietta et al., 2012; De Angelis et al., 2017). Both studies were retrospective. Three additional studies already included in this review in PICFDP were excluded from the SICFDP analysis. Romeo et al. (2009) had less than 10 patients treated with single implants, Hälg et al. (2008) and Malo et al. (2013) had a mean follow-up for SICFDP < 5 years.

A total of 44 prosthesis supported by 44 implants in 42 patients were analysed. All the rehabilitations supported monolateral cantilevers, 10 distal and 34 mesial. Both studies included either maxillary or mandibular rehabilitations.

Both studies reported on implants and prosthetic failure. Three implants out of 44 and 4 prosthesis out of 44 failed. Two implants were lost due to severe per-implantitis, one due to implant fracture. Two prostheses failed due to screw fracture, two due to abutment fracture. The estimated 5–10 years survival rate was calculated to be 97.80% (69.85–125.8) and 97.05% (59.57–134.5) for the implants and the prosthesis, respectively (Table 12).

In the paper by Aglietta et al. (2012) data regarding mechanical, technical and biological complications were not reported.

In the study by De Angelis et al. (2017) mechanical, technical and biological complications were reported: four prostheses failed due to abutment or screw fractures, two and two, respectively. The

TABLE 11 Biological complications (partial prostheses)

Study	No. implants/ICFDPs available for the analysis (patients)	Mean follow-up time (years)	Total implants/ICFDPs exposure time	No. of biological complications (peri-implantitis)	Estimated implant/ICFDP complication rate (per 100 implants/prostheses years)
Romeo et al. (2009)	116/59 (45)	8	928/472	2 (2)	0.22/0.42
Kreissl et al. (2007)	61/23 (20)	5	305/115	NR	NE
Brägger et al. (2005)	33/18 (14)	9.4	310.2/169.2	8 (8)	2.58/4.73
Wennström et al. (2004)	66/24 (24)	5	330/130	NR	NR
Cumulative 5-year complication rate prospective studies					4.04% (−68.05, 82.02) 7.80% (−123.8, 149.6)
Jokstad et al. (2017)	58/24 (24)	17.5	1,015/420	NR	NE
Malo et al. (2013)	153/119 (113)	5	765/595	6 (6)	0.78/1.01
Aglietta et al. (2012)	42/21 (21)	5.5	231/115.5	NR	NE
Hälg et al. (2008)	34/17 (17)	5	170/85	0	0.00/0.00
Eliasson et al. (2006)	176/71 (71)	9.8	1,724.8/695.8	NR	NE
Cumulative 5-year complication rate retrospective studies					3.21% (−22.94, 26.06) 4.41 (−29.5, 34,54)
Cumulative 5–10 year complication rate (95% CI)*					3.68% (−4.84, 13.78) 6.06% (−9.53, 24.93)

ICFDPs: implant-supported, cantilever-fixed dental prostheses; NE: not estimable; NR: not reported.

*Based on random effects Poisson regression, test for heterogeneity, $p = 0.80/p = 0.60$.

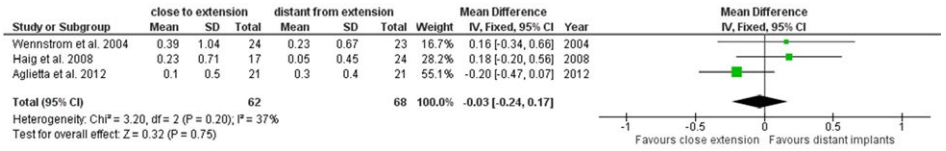

FIGURE 4 Marginal bone loss for PICFDP

study reported on 16 cemented and 9 screw retained restorations, followed for 10–18 years, with 5 veneer fractures, 2 unscrewed prostheses, 6 decemented prostheses. Two cases of perimplantitis and eight cases of mucositis were reported.

Marginal bone loss was reported in both studies with a range from 0.1 to 2.5 mm.

In one study rehabilitations were supported by Winsix Implants (25 implants and 25 rehabilitations), in one study rehabilitations were supported by Straumann Dental Implants System (19 implants and 19 rehabilitations).

4 | DISCUSSION

The focused question of the present review was "In what clinical situations and with what implant systems are cantilever a successful treatment modality?" Both retrospective and prospective studies were selected, with a minimum follow-up of 5 years and at least 10 patients. Fully edentulous situations treated with implant supported fixed reconstructions with cantilever (FAICFDP) were considered and reported in part II (Storelli, 2018). Partially, edentulous patients were divided into cases where one implant was supporting two teeth (SICFDP) and cases of two or more implants were supporting cantilevered prosthesis (PICFDP). A total of 25 papers were selected, of which 14 for the fully edentulous and 11 for the partially edentulous (9 PICFDP and 2 SICFDP). The screening phase was quite complicated by the fact that several papers did not specifically report on cantilever but were showing images and radiographs of cantilevered rehabilitations. Several emails were sent to the authors but the answer was quite scarce and very few authors were able to help in retrieving additional data for this review.

4.1 | Fixed partial rehabilitations

In this systematic review, five retrospective and four prospective studies were selected: a total of 739 implants supporting 376 rehabilitations in 349 patients were followed for at least 5 years (range 5–17.5). The estimated survival rate after 5–10 years was calculated to be 98.4% for the implants and 99.2% for the rehabilitations. A previous systematic review focused on PICFDP (Romeo & Storelli, 2012) reported an estimated survival rate of prospective and retrospective studies of 95.4% and 98.2% for the rehabilitations. Another systematic review (Pjetursson, Thoma, Jung, Zwahlen, & Zembic, 2012) assessed the survival rate of cantilevered and non-cantilevered partial rehabilitations: the survival rate of the prostheses was calculated to be 95.4% at 5 years. The survival rate of PICFDP rehabilitations appears to be similar to that of non-cantilevered restorations.

Complications of PICFDP were calculated to be in the present review at 5–10 years to be 26.6% for the rehabilitations. This is in agreement with the review of Pjetursson et al. (2012) which assessed that the success rate (i.e., the complications free patients) were 66.4% at 5 years. Although many complications can be considered as minor, it must be stressed the fact that these complications indeed occur and must be accounted for. Among the complications, implant fracture and peri-implantitis can be considered two major ones. In the current review, three implant fractures were documented with a cumulative 5–10 years complications rate of 0.31% (−0.97; 3.11). Pjetursson et al. (2012) calculated that the cumulative incidence of implant fractures was 0.5% at 5 years. Although a small figure, this incident needs to be addressed by clinician and manufacturers. In partially edentulous sites ceramic was the most used veering material. This choice is probably due to the aesthetic results that dental technician can obtain with ceramics. The chipping rate evaluated in the present paper was 18.9% in prospective studies and 11.9% in retrospective studies with follow-up ranging from 5 to 17 years. Resin veneering was reported only in two included studies. In a previous review, Ceramic chipping in implant supported fixed partial denture was calculated to be 8.8% at 5 years, while resin fractures were up to 15.7% at 5 years (Pjetursson et al., 2007).

In the current review, no studies reported on mucositis, while the data retrieved from four studies showed that peri-implantitis has a cumulative 5–10 years complication rate of 6.06% for the prosthesis. In Pjetursson review (2012), the cumulative rate of biological complications after 5 years for implant supported fixed partial dentures was 8.5%.

In the current review, MBL was reported in 5 studies with a range from 0.25 to 1.84 mm and a calculated estimated MBL after 5 years of 0.54 mm (−0.15, 1.52, CI 95%).

The summary estimated mean difference in bone loss between implants close to and distant from cantilevers (reported in three studies only) is −0.03 mm per year (−0.24, 0.17, CI 95%, *p*: 0.75). Similar results were obtained from Aglietta et al. (2009) and Romeo and Storelli (2012), their review reported a summary estimate mean difference in bone loss per year of 0.033 (0.02–0.087, CI 95%, *p*: 0.14). All the authors reported that there is no statistically significant difference in bone loss between implants close to and distant from cantilevers.

TABLE 12 Annual failure rates and survival of implants/ICFDPs (single implant)

Study	No. implants/ICFDPs available for the analysis (patients)	Mean follow-up time (years)	No. failures implants/ICFPDs	Total implants/ICFDPs exposure time	Estimated failure rate (per 100 implants/ICFDPs years)	Estimated implant/ICFDP survival rate after 5–10 years
De Angelis et al. (2017)	25/25 (25)	13.6	3/4	340	0.88/1.18	95.6%/94.1%
Aglietta et al. (2012)	19/19 (17)	6.5	0/0	123.5	0.00/0.00	100%/100%
Total Summary estimate (95% CI)*						97.80 (69.85;125.8) */97.05 (59.57; 134.5)

ICFDPs: implant-supported, cantilever-fixed dental prostheses.
*Based on random effects Poisson regression; test for heterogeneity, not calculable.

4.2 | Single implant supporting two crowns

In this systematic review, two retrospective studies were selected: a total of 44 implants supporting 44 rehabilitations in 42 patients were followed for at least 5 years (range 5–17.5). Estimated survival rate after 5–10 years was 97.80%(69.85;125.8) for implants and 97.05 (59.57; 134.5) for the rehabilitations. Romeo et al. (2009) analysed less than 10 cases of single implant supporting cantilevered prostheses and was therefore excluded, as well as Hälg et al. (2008) and Malo et al. (2013), whose mean follow-ups were less than 5 years.

In a recent systematic review (Van Nimwegen, Raghoebar, Tymstra, Vissink, & Meijer, 2017), single implant supporting two crowns were analysed. The review included five studies with a mean follow-up <5 years, none of which met the inclusion criteria in the present review. Survival rate ranged from 96.6% to 100% up to 3 years. In the present review, not enough data were retrieved about prosthetic and biological complications. Therefore, no conclusion can be drawn at the moment concerning complications in these clinical situations.

One limitation of the present review was that studies with different designs (both retrospective and prospective studies) were selected and analysed together. This was done in order to consider the widest possible amount of data available for analysis but might have contributed to increase heterogeneity of the datasets.

5 | CONCLUSIONS

On the basis of the present review, it is possible to acknowledge the use of cantilevered rehabilitations in partially edentulous patients. Implant-supported restorations with cantilever appear to be able to provide a high survival rate of the restorations in partially edentulous patients. Complications single implant supporting 2-unit cantilever appear to have scarce evidence concerning the survival and rate of complications.

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